Predictive Uncertainty

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Outline

- Reasons for conducting a predictive uncertainty analysis
- How the current procedure was selected
- The procedure
- Results

Reasons for conducting a predictive uncertainty analysis

- Establish the precision (not accuracy) for key model predictions
- Identify where more data can reduce predictive uncertainty
- Document the limitations of the model

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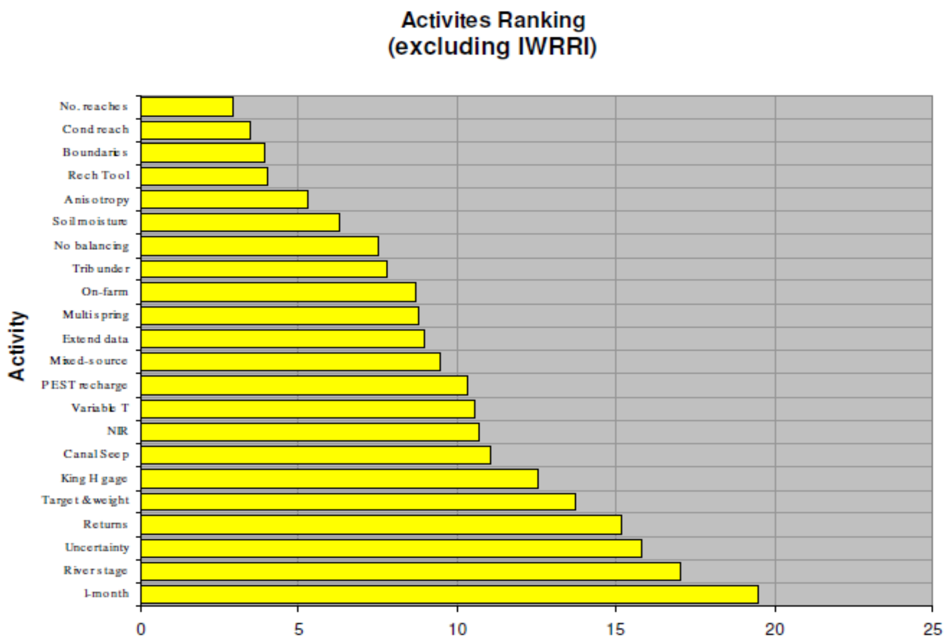
How the current procedure was selected



- 2007 uncertainty analysis was ranked third most important improvement to undertake in developing ESPAM2
- November 2009 ESHMC chose to evaluate predictive uncertainty using PEST
- March 2011 ESHMC unanimously agreed to proceed with a predictive uncertainty analysis immediately after calibration of ESPAM2
- June 2011 the committee limited the scope of the predictive uncertainty analysis to
  - Impact of each of eight Water Districts
  - On each of four reaches

The procedure

- Run MKMOD
- Run MODFLOW
- Compare model output with field observations
- Compare the sum of the squared residuals (phi) with PD0
  - PD0 is a value of the objective function (phi) which is considered calibrated
- Conduct the prediction
- Save the value if it is a new maximum (or minimum) and phi is low enough

Chosen uncertainty analysis

- Evaluate contribution to predictive uncertainty from
  - Adjustable components of the water budget
    - PEST is allowed to adjust many components of the water budget mostly through **scalars**
  - Adjustable physical parameters
    - Transmissivity, specific yield, conductance
  - Measurement uncertainty
    - to the extent that the weighting scheme takes into account measurement uncertainty

Adjustable components of the water budget

- Canal seepage by entity
- Non-irrigated recharge
  - 11 zones
- Evapotranspiration (ET)
  - ET on sprinkler irrigated lands by entity
  - ET on gravity irrigated lands by entity
  - ET on wetlands global
- Perched river seepage
  - 22 reaches
- Tributary underflow
  - 24 tribs
- Deep percolation of applied irrigation water by entity
- Soil moisture storage
  - Field capacity by entity
  - Soil depth by entity
  - Wilting point by entity

Results

- Uncertainty analysis results are based on E110712A001
- Current calibration is E120116A001
- Results are all preliminary
- Once the model is calibrated ESHMC will have to chose PD0

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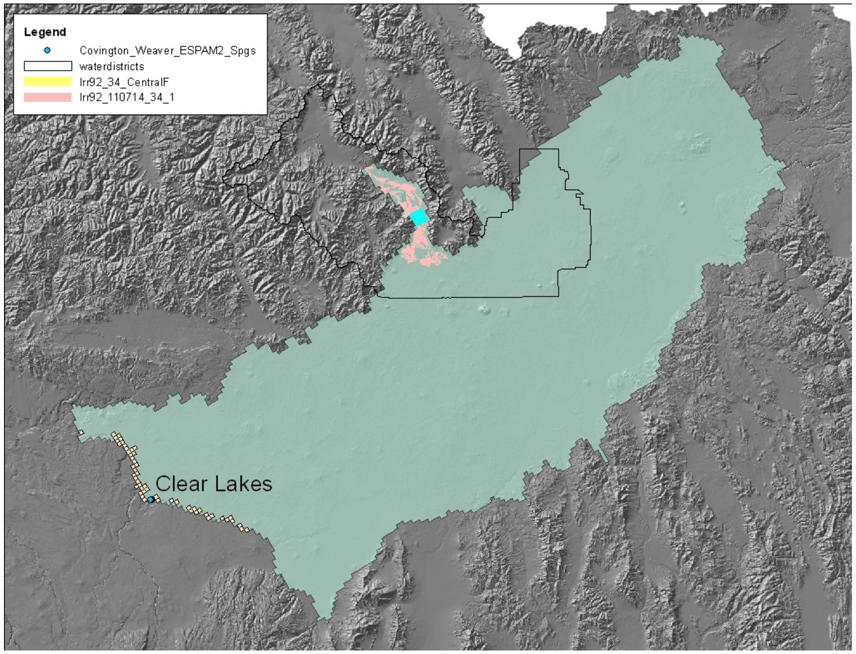
Establish the precision for key model predictions



Prediction is for impact at the Centroid of Water District on Clear Lakes

Centroid	Calibrated Impact	Maximized Impact	Minimized Impact
WD110	0.17%	0.17%	0.16%
WD120	0.45%	0.93%	0.39%
WD130	7.11%	7.36%	6.93%
WD34	2.73%	3.39%	0.44%

Identify where more data can reduce predictive uncertainty

- Data that would constrain the conductance of American Falls Reservoir would reduce the predictive uncertainty for impact of 3x3 block in WD120 on Clear Lakes
- Data further constraining Big Lost underflow would reduce uncertainty for predictions from 3x3 block in WD34 on Clear Lakes

Document the limitations of the model

- Precision is high when predicting impact of 3x3 block of cells in WD130 and WD110 to Clear Lakes Spring.
  - Probably also high for predicting 3x3 block of cells to other springs.
  - Probably also high for predicting impact of WD130 and WD110 on springs.
- Precision is not as high when predicting impact of 3x3 block of cells in WD120 and WD34 to Clear Lakes Spring.
  - Confident that, given assumptions in E110712A001, impact from 3x3 block in WD120 on Clear Lakes Spring is less than 1%
  - Confident that, given assumptions in E110712A001, impact from 3x3 block in WD34 on Clear Lakes Spring is less than 3.5%

Activites Ranking (excluding IWRRI)